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Physico-chemical status of farmland soil in Warora, dist: Chandrapur (Maharashtra), India

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ABSTRACT

Soil is a natural body of mineral & organic material differentiated into horizons, which differ among themselves in their morphology, Physical, Chemical & biological Characteristics. Plants depend on the soils for their nutrients, water & mineral supply. The soil type is a major factor for determining what types of plants will grow in any area. The physico-Chemical study of soil is based on various parameters like pH, Electrical Conductivity (EC), total organic Carbon (OC), Available Nitrogen (N), Available Phosphorous (P_2O_5), Available Potassium (K_2O), Exchangable Calcium & Magnesium. Three soil samples were collected from three sites of farmland for soil analysis i.e. Sembal Village, Marda Village, and Ekarjuna village which are located near warora. Physical and chemical analysis of soil have done by different methods. Estimation of total Nitrogen (Kjeldahl method), Available Phosphorous (Bray's & Olsen's method), Available potassium (Flame photometric method) & exchangable Calcium & Magnesium (EDTA titration method). Fe, Mn, Zn, Cu determined by DTPA method. The results Shows that, samples taken have various parameters like EC, pH, OC, N, P, K, Ca, Mg, and Fe, Mn, Zn, Cu. The results depend on quality of soil samples.

Keywords- soil analysis and its methods, Kjeldahl, Flame photometric, Bray's, EDTA and DTPA Method.

INTRODUCTION

Soil is the surface on the earth crust where Geology & Biology meet & the land surface that provides a home to plant, animal & microbial life. (Pelczar *et al.*,1993). Joffee (1949) reviewed the soil is a natural body of mineral & organic material differentiated into horizons, which differs among themselves as well as from underlying materials in their morphology, physical make-up, Chemical composition & biological Characteristics. Solanki and Chavda (2012). Soil types are a major factor

for determining what types of plants will grow in a certain area as plants use inorganic elements from the soil such as nitrogen, potassium and phosphorous. Nitrogen and Phosphorous are not available to the plant directly. They are incorporated in the organic material. Potassium is present in elemental or exchangeable form. Calcium & magnesium interfere in the soil activity as well as activate several plant enzyme systems. The deficiency of any of these elements has retarding effect on the growth of plants. The most significant discovery was that of the german chemist Justus von leibig (1840) showed that the growing plant obtained element calcium, potassium, sulphur and phosphorous from soil. For the first time he showed that plants obtained their carbon supply from carbon dioxide in air & not from soil. The elements of micronutrients are used in field a very small quantity or in a trace amounts. They are iron, zinc, manganese and copper but they are important as major elements in plants nutrients. For maximizing quality and productivity of crops, all these essential nutrients must present or supplied in balanced form.

The availability of mineral nutrients is controlled by the chemical and physical properties of the soil. The cation exchange properties of the soil clay and organic matter regulate the availability of the cation nutrients. Availability of organic sources of N is dependent upon mineralization of the N to the inorganic forms, ammonium and nitrate. The solubility of most micronutrients is affected by soil, pH and organic matter content to assess the sufficiency of the mineral nutrients for optimum plant growth. For sustained high crop yield, the application of nutrients is required. Efficient use of applied nutrients depends upon the timing and methods of nutrient application. The chemical and physical properties of the soil which determine methods of application and soil management practices are best suited for a given soil (Kamprath and Watson 1980).

Mitscherlich *et al*. (1925) conducted extensive studies on the effect of quantities of nutrients in soils on dry matter yields and found that a simple exponential function could relate one to the other. The function can be fitted to observe yield resulting from incremental applications of fertilizer and provides yield response curve that describes expected yield as a continuous and smooth function of nutrient availability. Nitrogen occurs in several forms as a Nitrate (NO_3^-) and Nitrite (NO_2^-) anions, ammonium (NH_4^+) and organic compounds. Adequate supply of These elements are associated with the plant growth & the deep green plant color. The nitrogen deficient soil has stunted plant growth and shows signs of chlorosis. Phosphorous is occurs in soil in both organic and inorganic form. The organic form is more important for the crop nutrition. The supply of P at the early vegetative growth phase strengthens its reproductive parts and formation of seeds. Deficiency will lead to discoloration of older leaves and leaf edges. Potassium is present in the soil in different form. The requirement of plant for K is high because plants absorb it in higher amount than other nutrients. The deficiency of K leads to chlorosis or necrosis. Calcium is present in the soil either as soluble Ca_2^+in complex form or a free calcium carbonate ($CaCO_3$) and act as plant nutrient at the same level as N, P and Mg and pH regulator. Magnesium is a main constituent of chlorophyll molecule, related to metabolism of phosphorous, activates number of plant enzymes and absorbed by plant roots as Mg^{++} ion. If the soil is Mg deficient, the plant grown in such soil will become pale yellow and then turns brown and necrotic.

MATERIAL AND METHOD

Three sites were selected for soil analysis ie. Farmland of Sembal Village, Marda Village, and Ekarjuna village which are located near Warora. Soil samples were collected from three sites of Warora taluka. Each soil samples were taken from a depth of 15 – 20 cm in a quadric manner. After collection, the soil samples were spread for air – drying. After proper drying large stones and other similar objects were removed. Then the soil was ground with the help of mortar and pestle to break up aggregates and the crumbs. After that soil pass through 2mm sieve and stored in a clean polythene bags and labelled properly with necessary information of field. Physico-chemical parameter of soil samples were analysed by using different methods. pH was measured by using pH meter, EC determined (conductivity meters), OC (Colourimeter), Available Nitrogen (Kjeldahl method), Available phosphorous (Bray`s method for acidic soil, olsen`s method for neutral and alkaline soil), Available potassium (flame photometric method), Exchangeable Ca and Mg (EDTA titration method) and Fe, Mn, Zn, Cu determined by DTPA method.

Sample no.	Name of different places
Site - 1	Farmland of Sembal village
Site - 2	Farmland of Marda village
Site - 3	Farmland of Ekarjuna village

RESULT AND DISCUSSION

Analysis of soil samples showed that the value of pH ranges from 6.9 - 7.4 indicating that the soil are neutral to slightly alkaline. The highest pH was recorded in site 1 (7.4) and lowest site 2. (6.9) pH greatly affects solubility of minerals and another parameter. The measurement of EC gives the concentration of soluble salt in the soil at any temperature. The variation of EC is due to the higher concentration ions in solution and directly related to soluble salt concentration. The value of EC ranges from 0.19 – 0.49 dSm^{-1}. The highest value recorded in site 2 (0.49 dSm^{-1}) and lowest in the site 1 (0.19 dSm^{-1}). Wagh, et. al, (2013) state that soil with EC below 0.4 dSm^{-1} are considered saline while soil above 0.8 $dSm^{-1}$are severely saline. Organic carbon ranges from 0.22 – 0.85%. The value of OC was recorded highest in the site 3 (0.85%) and lowest in the site 2 (0.22%). In the colorimeter method, organic matter is oxidized with chromic acid, standard value of OC < 0.50, medium 0.50 – 0.75 and high > 0.75 (Datta *et al.,* 1962).

Available nitrogen helps the plants for rapid growth, increasing seed and fruit production and improving the quality of leaf and forage crops. In the present investigation nitrogen value ranges from 69.8 - 153 kg/ha. It was maximum in the site 3 (153 kg/ha) and lowest in the site 2 (69.8 kg/ha). It can be applied to the soil in the form of urea. Farmers are advised to use biofertilizers like Rhizobium, Azotobactor and Nitrogen solubilizing bacteria. Ranges of Phosphorous was 14.1 – 50.1 kg/ha and potassium 553 – 276 Kg/ha. Maximum P was found in the site 1 (50.1 Kg/ha) and lowest in site 2 (14.1Kg/ha). Maximum K was reported in the site 3 (553 kg/ha) and lowest in the site 2 (276 Kg/ha). Availability of phosphorous is medium while availability of potassium is very high due to excessive potassium fertilizer. Calcium ranges from 31.5 – 32.8 Kg/ha and Magnesium ranges (6.66 – 23.6 Kg/ha). Maximum value of Ca was reported in the site 3 (32.8 kg/ha) and lowest in the site 2 (31.5 Kg/ha). Present investigation of Mg value was highest in the site 1 (23.6 kg/ha) and lowest in the site 2 (6.66 kg/ha).

Micronutrients like Fe and Zn are less 25 – 30 kg/ha Ferrous sulphate and Zinc sulphate can be apply to the soil. The Fe ranges from (0.35 – 0.73 Kg/ha), Mn (3.02 – 4.33 Kg/ha), Zn (0.22 -0.24 Kg/ha) and Cu (0.35-0.53) Kg/ha. The soil at Munipallein Gunter district of A. P. was clay loam with pH 7.9, EC 0.7 dSm^{-1}, Available N, P and K, 155 - 66 - 195 kg/ha respectively (Ramani and Pillai, 1992). Jadhav et al (1990) reported at Pune was loam texture, slightly alkaline in reaction, pH 8.2, low available nitrogen (65.65 kg/ha), medium in available P (26.74 kg/ha) and rich in available K (462.36 kg/ha) for pearl millet.

Indian soil range of an available micronutrients status of Fe 0.8 -196 mg/kg, Mn 0.2 -118 mg/kg, Zn 0.2 – 6.9 mg/kg and Cu 0.1 - 8.2 mg/kg (Singh, 1999). In Vidarbha, 5014 soil samples analyzed, available Fe, Mn, Zn, and Cu status in soils. Out of these, Fe is low 12% samples, medium in 48% samples and high in 40% samples. Fe deficiency was observed in Maharashtra, particularly Nagpur district, out of 524 soil samples analyzed for Fe and observed that Fe was found to be 8% low, 49% medium and 43% high. The available Fe varied from 3.10 to 9.34 ppm with mean value of 3.58 ppm. (Patil *et al*., 2004). Giri (2007) reported soil from Thane district pH 6.6% , moisture content 8.3% different mineral present in the soil 10 kg Cu/ha, 25 kg Fe/ha, 15 kg Mn/ha, 5 kg Zn/ha, 30 kg Ca/ha and 35 kg Mg/ha for growth of Fenugreek and Mustard.

Table-1 Physico- chemical analysis of soil

Soil Sample	PH	EC dSm^{-1}	OC %	Macronutrients (Kg/ha)					Micronutrients (ppm)			
				N	P	K	Ca	Mg	Fe	Mn	Zn	Cu
Site-1	7.4	0.19	0.48	73.6	50.1	431.96	32.8	23.6	0.49	4.33	0.22	0.47
Site-2	6.9	0.49	0.22	69.8	14.1	276.0	31.5	6.66	0.73	3.92	0.24	0.53
Site-3	7.3	0.24	0.85	153	36.9	553.0	32.5	16.2	0.35	3.02	0.22	0.35

EC (dSm^{-1}), OC(%), N, P, K, Ca, Mg (kg/ha), Fe, Mn, Zn, Cu (ppm).

CONCLUSION

From the above results, concluded that, the essential information's of the soil status were known, that helps in maintaining the physical condition of soil and help in providing proper mineral nutrients. Nutrient analysis is the measurement of nutrients present in the soil which is removed from the soil using an extracting solution. Most of the farmers are using excessive chemical fertilizers and the too much dose of such fertilizers in soil. So therefore, Soil testing needs in determination of such requirements, which helps in balanced fertilization for future to avoid deficiency/ toxicity of different plant nutrients and helpful to microbial population in soil. Thus, the recommendation for application of plant nutrients and their doses depends on soil fertility status. This information will helpful to farmers to decide the problems related to soil nutrients, amount of fertilizers to be added to soil to make production economic.

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